

## **ABSTRACT OF THE INVENTION**

A novel artificial muscle material and miniature valves and micropumps made therefrom are provided. The artificial muscle material bends reversibly when electroactuated by applying low voltage, in a wide pH range, even at that of physiological pH, and works without contact with electrodes. Miniature valves made from the artificial material are successfully triggered for the fluid release in a wide pH range, even at that of physiological pH. Novel fluid release devices were manufactured using this artificial muscle, and methods using the same were provided, including an implantable device optimized for trans-scleral drug delivery.